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## Centers for Disease Control and Prevention Model Performance Evaluation Program Retroviral and AIDS-Related Testing Program Description

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In 1986, the Centers for Disease Control and Prevention (CDC) implemented the Model Performance Evaluation Program (MPEP) to evaluate the performance of laboratories that perform tests to detect human immunodeficiency virus type 1 (HIV-1) antibody (Ab). In September 1989, evaluation of laboratories that test for human T-lymphotropic virus types I and II (HTLV-I/II) Ab was included in the MPEP. In October 1990, the MPEP was expanded to include evaluation of laboratories that perform T-lymphocyte immunophenotyping (TLI) by flow cytometry. In 1996, the program was again expanded to include HIV-1 ribonucleic acid (RNA) and signal amplification technologies to determine viral load, and HIV-1 p24 antigen (Ag) testing. The impetus for developing this program came from the recognized need to assess the quality of retroviral and AIDS-related laboratory testing and to ensure that the quality of HIV-1 and HTLV-I/II Ab testing, TLI, HIV-1 viral RNA determinations, and HIV-1 p24 Ag testing was adequate to meet medical and public health needs. The objectives of the MPEP are (1) to develop appropriate methods for evaluating quality in laboratory testing systems (including test selection, sample collection, and reporting and interpreting test results); (2) to develop strategies for identifying and correcting testing quality failures; and (3) to evaluate the effect of testing quality on public health.

Recruitment for volunteer enrollment in the MPEP is ongoing by CDC (to date more than 17,000 laboratories have been contacted). Not all of the laboratories contacted perform HIV-1 Ab (or HIV-2 Ab) testing, HTLV-I/II Ab testing, TLI, HIV-1 viral RNA determinations, or HIV-1 p24 Ag testing, but of those that do perform these tests and participate in the MPEP, approximately 1,000 perform HIV-1 Ab testing, 250 perform testing for HTLV-I/II Ab, and 330 perform TLI. The HIV-1 viral RNA and HIV-1 p24 Ag testing performance evaluation projects were just implemented in 1996 and, currently, approximately 185 are enrolled for viral RNA testing and 200 for p24 Ag testing.

The MPEP is designed to analyze the steps in the total testing process and to identify the critical indicators of high-quality HIV-1 and HTLV-I/II Ab testing, TLI, HIV-1 viral RNA determinations and HIV-1 p24 Ag testing. Participant laboratories are requested to test the performance evaluation (PE) samples that CDC mails them in the same manner they test routine clinical specimens, and to report their testing results to CDC on specially designed forms. Aggregate data are derived from the testing results of enzyme immunoassay (EIA), Western blot (WB), indirect immunofluorescence (IIF), radioimmuno-precipitation assay (RIPA), other tests, TLI cell counts and percentages, copies of HIV-1 viral RNA, or the presence of HIV-1 p24 Ag, provided to CDC by each of the laboratories. CDC is responsible for compiling and analyzing the results and sends aggregate reports of testing results to all participant laboratories following each PE survey. The reports consist of tables and graphical figures, grouped for each

performance evaluation sample, for example, by test kit manufacturer, test method, WB band patterns, and IIF fluorescence. A written analysis of results accompanies each final report. Although the MPEP is not a regulatory program, laboratories find the aggregate reports of testing results beneficial in comparing their results with those from other laboratories. This practice affords each laboratory with the opportunity for self-improvement and serves as a vehicle to accomplish an important objective of the MPEP: improving and maintaining high quality HIV and HTLV Ab testing, TLI, HIV-1 viral RNA determinations, and HIV-1 p24 Ag testing. Periodic brief reports highlighting important findings are sent to MPEP participants, usually after aggregate reports have been distributed. Reprints from CDC Morbidity and Mortality Weekly Report (MMWR) publications and from CDC authored peer-reviewed journal publications concerning retroviral or AIDS-related testing are also sent to program participating laboratories.

The PE surveys depend upon a wide spectrum of laboratory participation to generate a representative data base. To accurately assess the quality of laboratory testing, we need the participation of laboratories that represent all levels of performance. Experience has shown that laboratories performing poorly in a PE program will drop out of voluntary programs if their anonymity is threatened. Losing wide-based participation, particularly of poor performers, would bias the data, jeopardize outcomes of the study, and lead to a false impression of testing quality. Further, less than 10% of the laboratories participating in the MPEP do not participate in other major proficiency testing or performance evaluation surveys. Past CDC experience has also shown that participation in PE surveys leads to improved testing performance. By taking a position that encourages participation in the PE surveys, CDC is giving participant laboratories an opportunity for self-improvement and, in addition, a basis for developing prevention and intervention strategies.

Annually, the MPEP mails two performance evaluation sample panels each for HIV-1 Ab, HTLV-I/II Ab, TLI, HIV-1 viral RNA, and HIV-1 p24 Ag. Interest in the program is quite high; approximately 90 percent of the laboratories receiving sample panels have responded with results. This high rate of participation indicates strong support for achieving the goal of improving and maintaining high quality laboratory testing. In addition to sample panel surveys, participant laboratories are asked to complete a survey questionnaire (SQ) describing the characteristics of their laboratory and their testing practices. For HIV and HTLV, this SQ is administered every other year, while for TLI SQs are administered annually. Future SQs for HIV-1 viral RNA and HIV-1 p24 Ag are planned.

To identify and assess barriers to high-quality laboratory testing in preanalytic and postanalytic steps of HIV-1 and

HTLV-I/II Ab testing, TLI, HIV-1 viral RNA determinations, and HIV-1 p24 Ag testing, CDC collaborates with the Association of Schools of Public Health and San Diego State University Graduate School of Public Health to develop systematic analyses for identifying variables in the steps of the testing process. These analyses are used to assist in cataloging events that occur from the time tests are requested through specimen collection, laboratory analyses, and reporting of test results so that potential problems, particularly in the preanalytic and postanalytic steps of the testing process, can be identified and corrected.

We recognize that certain individuals and organizations need to know the quality of laboratory testing and share in the responsibility for assuring high quality. Some of these individuals and organizations are as follows:

Physicians, patients, and other persons who either want to identify laboratories that perform well or evaluate the performance of laboratories they use.

Government agencies or other entities who have regulatory oversight responsibilities for quality assurance of laboratory testing and test results.

Persons with contractual or other binding arrangements with particular laboratories to perform testing.

The MPEP is responsible for the detailed analysis of aggregate data that may be useful to all these groups; however, it does not grade results from individual laboratories. Graded laboratory proficiency testing surveys are conducted by the College of American Pathologists (CAP) and the American Association of Bioanalysts (AAB). Of the approximately 1,000 laboratories enrolled in the MPEP for HIV-1 Ab testing, greater than 90% are also enrolled in programs sponsored by CAP or AAB.

The MPEP focuses on answering such questions as the following:

What are the testing practices and characteristics of laboratories that test for HIV-1 and HTLV-I/II Ab, perform TLI, determine HIV-1 viral RNA, or detect HIV-1 p24 Ag?

Do these practices affect quality in the laboratory testing process?

Is the high quality of laboratory testing dependent upon the nature of the laboratory itself, e.g., public health versus blood collection center versus hospital-based laboratory, versus independent laboratory, numbers of samples tested, types and sequence of tests performed, internal and external quality assurance procedures implemented throughout the testing process, education and training of testing personnel, or experience of personnel performing the testing?

What strategies for correcting quality failures are most effective and how can they be implemented?

The PE survey data are only a portion of the information needed to answer these kinds of questions. Other information is needed that more accurately and concisely describes laboratories' testing practices and test quality. These data will be collected through ongoing MPEP research. At this time, we have data that is assisting us in evaluating laboratory performance. Currently, we provide the following:

Reports that contain graphical figures and analyses of the PE sample survey and questionnaire results compositely and by single descriptive variables, e.g., kit manufacturer and laboratory type, which will be useful as indicators in detecting and screening performance deficiencies and quality results.

Publications, e.g., MPEP Performance Bulletins addressing specific testing performance issues, MMWR articles describing specific aspects of performance results, and peer-reviewed journal publications directly addressing testing issues.

Through statistical analyses, we are examining the data provided by participant laboratories that will help us develop a profile of the characteristics which distinguish a laboratory testing process that performs consistently well from one that performs poorly. This information will be invaluable for evaluating testing laboratories, but will be essential for targeting strategies for improving the quality of laboratory testing.

High-quality HIV-1 and HTLV-I/II Ab testing, and HIV-1 p24 Ag testing is essential to meeting the public health objectives for the prevention and control of these retrovirus infections. High quality TLI and viral HIV-1 RNA determinations are essential to HIV-infected patient care and management, and the mission of reducing retrovirus-associated morbidity and mortality. Prevention programs, diagnostic clinics, and seroprevalence studies rely not only on accurate antibody testing results to document HIV and HTLV infection, but also accurate TLI, HIV-1 viral RNA determinations, and HIV-1 p24 Ag testing results. In the environment of expanding technology, changing test applications, and increasing numbers and types of laboratories performing testing, the quality of laboratory testing must be assessed by a performance evaluation program such as the MPEP to assure that test results satisfy user requirements. By maintaining a system for collecting data needed to make assessments and by making available aggregate results, CDC will meet its goal of assuring high quality in laboratory testing.

Future plans of the MPEP include (1) refinement of performance panels to evaluate new methods in HIV-1 and HTLV-I/II Ab testing, new or changing methods in performing TLI, new methods in determining HIV-1 viral RNA, and new methods to detect HIV-1 p24 Ag, (2) expansion of the survey

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design to broaden our knowledge about the level of quality in the preanalytic and postanalytic steps of the testing process, and (3) recommendation of intervention strategies for laboratory improvement.

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